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A BIOLOGICAL EVALUATION OF THE NORTH FORK TIMBER STAND COMPARTMENT, SAN JACINTO RANGER DISTRICT, SAN BERNARDINO NATIONAL FOREST

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A biological evaluation, requested by the San Bernardino National Forest, was completed in the North Fork Timber Stand Compartment, San Jacinto Ranger District, on September 20 and 21, 1977. John Pronos, FIDM Staff, conducted the evaluation and was joined by Ed Stocks on the afternoon of September 20.

The area of interest contains mainly Coulter and Jeffrey pines of small sawtimber size. There is also a sporadically distributed, but significant, component of California black and live oaks. Many of the oaks, of sprout origin, are multiple-stemmed trees.

The primary objectives of the evaluation were to determine if there is a potential threat of Armillaria root rot in the area, and to incorporate the findings into a silvicultural prescription now being prepared by Jim Bridges.

The root rot fungus, Armillaria mellea, is not usually a serious problem where conifers and hardwoods (oaks) grow in the same area. This fungus is commonly found on oak roots, but does little damage to the oak as long as the tree remains alive. When oaks are killed or cut, however, the fungus will colonize the stump and roots, utilize them as a food base, and finally spread to and kill adjacent conifers.

Examination of the compartment confirmed the presence of Armillaria mellea. Currently it is causing very little pine mortality. An active root rot center was found near Alvin Meadows, and signs of the pathogen were also visible on oak stumps. From a potential disease hazard standpoint, it should be assumed that the fungus is present on the oak throughout the area. Silvicultural procedures that alter the amount of oak in the stand could result in various levels of pine mortality from Armillaria root rot.

The following statements, based on our current knowledge of Armillaria mellea, may provide alternatives for the forest manager:

1. If the oak is left undisturbed, the current low level of root rot-caused mortality would most likely continue. This approach would rule out the possibility of improving either the oak or pine in the stand.

2. If several stems of multiple-stemmed trees are removed and the parent root system and remaining stem(s) do not die, there should be no significant increase in Armillaria root rot. As long as oaks are living they do not provide effective food bases for the fungus. In such a situation the District still has the option of underplanting pine around the thinned oak. In the long run the pine should outgrow and overtop the oak. Oaks that gradually deteriorate and die out over a long period of time do not favor the build-up of Armillaria mellea. If pine is planted, however, it will be endangered by locally heavy dwarf mistletoe infections present in the overstory pine.

3. If all the stems of multiple-stemmed trees are removed, it is best from the standpoint of disease prevention to also remove the stump and roots. In general, as the number of stumps produced in a given area increases, so does the probability of root rot. Elimination of the oak-food base is a recommended control procedure where feasible.

4. If oaks are cut and the stumps cannot be removed, pine seedlings should not be planted near the stumps. This would be the situation most likely to foster pine mortality. Older pines are usually more resistant to root rot than younger ones, and small seedlings are the most susceptible. Very small oaks, especially young reproduction, can usually be removed without danger of increasing root rot.

CONCLUSIONS

After considering the overall disease potential situation, we conclude that the best approach is to maintain mixed conifer-hardwood stands. Thinning the crowns of larger oaks and reducing the number of stems/tree are beneficial steps, but complete oak-tree removal is not. The advantages of having hardwoods in the stands include:

1. Living oaks do not present the danger of A. mellea building up.

2. Living oaks provide a natural barrier to dwarf mistletoe spread.

3. Living oaks can reduce the spread of Fomes annosus between pines because they are non-host trees. (Annosus root rot has been identified previously in this area, and planting oaks between the pines has been suggested as a control.)

Included with this evaluation is a three-page guideline for sprout-oak management. These guidelines were formulated in the East and were designed to reduce the amount of heart rot transmitted to sprout oaks from the parent stump. Oak species in California are different from those in the East, and there are some different wood decay fungi in this area, but notice that this information does apply to Armillaria mellea in eastern oaks. The data and statistics presented in this report may not be up to date or apply to California, but the conclusions and recommendations provide good background information to be used wherever oak sprouts are managed.

Management and Decay of Sprout Oak Stands[1/]

Introduction

According to the latest Timber Resource Review, the outlook for forestry appears quite favorable, but the potential demands for wood and cellulose products in the future pose a tremendous challenge to American forestry. The U. S. must rely chiefly on domestic timber resources, of which we have no excess. One-fourth of our forest land is poorly stocked; another 10% needs planting. Current productivity is low in relation to the biological potential of the land.

Nearly three-fourths of all commercial forest lands are in private ownership. Forest conditions are poorest on farms and other small private ownerships which hold 60% of the commercial forest lands. It is said that small ownerships (4.5 million) are the key to the nation's future timber supplies. Eighty-five per cent are in holdings of less than 100 acres and 50 per cent in holdings of less than 30 acres.

Tree diseases take a heavy annual toll from farm woodlots, and much of this loss is preventable. Considerable loss has resulted from severe mistreatment in the past. Actually, farm woods are especially suited to disease control, since their small size permits the elimination of defective trees and inferior species by frequent light cuts for many uses. At present, very little farm woodland improvement is done, probably because few farmers realize the potential value. In fact, in an unmanaged oak woodlot which is more than 120 years old, there probably will be an annual net loss--mostly through decay. Under proper management, the growth of farm woodlot timber could be increased two or three times.

Decay, which is one of the greatest causes of loss, can be greatly reduced by protecting woodlots from fire and grazing, by avoiding the wounding of trees, by salvaging damaged trees, and by proper management of sprout hardwood stands. For example, in the hardwoods of the South, 77% of the cull is butt rot and 91% of the butt rot originated at fire scars. Hence, under such circumstances, simple fire control would go a long way to reduce decay loss in the butt log. In eastern hardwoods, 54% of the logs are low grade and 20% of the trees are cull.

The second-growth oak forests of the eastern, central, and southern U. S. are largely of sprout origin, and the proportion of sprout trees is generally increasing. The typical mixed-oak woodlot of southwestern Wisconsin is even-aged, and about evenly composed of trees of seedling and sprout origin. The sprouts make a vigorous and rapid growth in the early years, and may have an advantage for short rotations, but the trees originating from seed are generally more free from rot and other defects, and produce higher quality timber in longer rotations. Trees of sprout origin generally incur considerable butt rot.

Origin and development of oak sprouts

Sprouts of oaks as in most hardwoods generally originate in the root collar region from dormant buds on the side of the stump during the first year after cutting. Stumps from old trees usually do not develop sprouts because the dormant buds on such trees have died. Roth and Hepting found stumps of white oak, 16 inches in diameter or 100 years old, sprouting prolifically, while stumps above these limits sprouted very little. Black and scarlet oak stumps sprouted well up to about 22 inches in diameter, or 150 years old, but very little above. Stump height, season of cutting, presence of butt rot at cutting, and the occurrence of fire immediately after logging, had little effect upon the amount of sprouting.

In general about 6 to 8 sprouts were produced per stump with as high as 20 in some cases. After 5 years sprouts were reduced to 1 to 3 per stump by competitive growth. Little relationship was found between the rate of mortality and stump diameter indicating sprouts from large stumps were as persistent as those from small sprouts up to 5 years. The height of sprout growth after 5 years ranged from 11 to 15 feet, varying with oak species. Low cut stumps produced ~~lower~~ sprouts with stumps exposed to fire producing sprouts of lowest origin.

1/Prepared by Dr. R.F. Patton, Department of Plant Pathology, University of Wisconsin Madison, Wisconsin 53706

Two-thirds of all sprouts arose at or below the ground level.

Symptoms

Oak stump sprouts are very susceptible to decay, particularly from the decaying parent stump. Northern hardwoods commonly decay through the large wounds left at the base of the sprout when the parent stump rots away.

Sprout oak stands infected with butt rot are characterized by multiple stems, swollen bases, presence of fungal fruiting bodies, and parent stump wounds. Most butt rots are soft and crumbly, dark, and often powdery.

Butt decay may vary in sprout oak stands from zero to sixty per cent of the stems decayed, depending on size of parent stumps, previous history of stands, height of sprout origin and species involved. The per cent of total tree volume amounts to 3 or 4 per cent for single-stemmed trees with swollen butts and 4½ to 8 per cent for multiple-stemmed trees. Losses were determined as that part of the stump above normal stump height. Roth found the average height of decay to be approximately 3 feet, in studies of 45 sample plots, with an average of 25 per cent of the trees butt rotted.

Among the fungi listed by Roth and Sleeth as causing butt rot, three of the fungal species were responsible for 82 per cent of the butt rot cases determined. Stereum gausapatum Fr. was isolated in 62 per cent of the cases. It attacks all oak species and produces rot readily after gaining entrance to the heartwood. Fistulina hepatica and Armillaria mellea each occurred in 10 per cent of the decay cases, with the remaining 18 per cent consisting of 16 fungus species.

Mode or avenue of entry

In 86 per cent of decay cases determined, the rot was traced to the parent stump. Cut or dead companion sprouts were the avenue of entrance in 3 per cent of the cases. Source of infection was undetermined in 6 per cent of the cases, and in the remaining 5 per cent the point of entry was old fire wounds. Roots were not found to be a source of infection. Lack of heartwood in the roots prevented invasion by heart-rotting fungi. Wounds caused by logging practices served as other points of entry.

Two factors are of prime importance in affecting transmission of decay from stump to sprout: (a) height above ground that the sprout originated on the stump, and (b) diameter of the stump. Sprouts of high origin and from large stumps commonly resulted in decayed sprouts. The avenue of transmission was shown to be the heartwood connection between the new sprout and the decaying wood of the parent stump.

Factors affecting incidence of decay

Size and condition of parent stump.--Sprouts arising from stumps of large diameter are more subject to butt rot than those arising from smaller stumps.

Height of sprout origin.--Per cent of decay cases increases with the height of a sprout origin up to 4 inches.

Wounds in sprouts caused by parent stumps.--The type of wound from the parent stump affects decay incidence.

--Open base wounds - those extending to the ground level.
--Loose wounds - those where sprout had partly grown around the parent stump, but still parts of stump protruding from the opening.
--Tight wounds - those where sprout had grown around a portion of old stump and held it tight.
--Closed wounds - sprout completely grown over parent stump, remains swollen at base.

Time and extent of heartwood formation.--Decay transmission takes place between the sprout and parent stump when there is a union between sprout heartwood and the parent stump. If decay is active at the time of union, the

possibility of decay transmission is high. No infections were observed through the sapwood.

Presence of companion sprouts.--Common types of twin stems are V- and U-shaped crotches. Chances of infection after cutting are less in U-shaped crotches because of sapwood saddle separating the heartwood of the two stems.

Control measures

Reduction of extensive decay losses in sprout hardwood stands can be accomplished by proper management procedures.

There are two types of stands to be considered in any control measures dealing with sprout oaks: (a) young sprout stands (under 20 years), in which decay can be kept to a minimum by proper treatments early in the life of the stand; (b) older sprout stands (over 20 years), in which the ultimate decay can be reduced by proper cultural methods.

Roth and Sleeth recommend control measures as follows:

(a) Young stands
  (1) Seedlings or seedling sprouts should be favored as crop trees over stump sprouts.
  (2) Sprouts from small stumps (less than 3 to 4 inches and not over 6 inches in diameter at ground level) should be favored over sprouts from large stumps.
  (3) Sprouts of low origin should be favored over those of high origin and sprouts from low cut stumps over those from high cut stumps.
  (4) In selection and thinning of fused sprouts (V-shaped and U-shaped crotches) cut flush at the crotch for more rapid healing.

(b) Older, established sprout stands
  (1) Cut out sprouts with stump wounds not yet grown over or sprouts with enlarged butts.
  (2) Single sprouts are preferred over fused sprouts.
  (3) Clumps of large sprouts fused above ground should be eliminated entirely or left to stand.

(c) For all stands cultural practices recommended are:
  (1) Keep decay at a minimum in long rotation crops.
  (2) Avoid long rotation crops on areas which have repeatedly cut over.
  (3) Remove trees wounded by fire.

Hepting recommends thinning of sprout clumps to one low origin sprout at an early age of 8 to 15 years. Roth and Sleeth found incidence of butt rot was positively correlated with the height of sprout origin on the parent stump. They recommend three practices for insuring low origin and therefore relatively rot free sprouts: (a) cutting stumps close to the ground, (b) burning the area after logging, and (c) removing the high origin sprouts early in young stands. Burning the woods immediately after cutting greatly reduced the rot developing in the new sprouts by killing the high buds on the stumps. In plots burned after logging before establishment of the sprout stand, they found that the percentage of butt-rotted trees ranged from 0 to 17, and in plots not burned over 15 to 64 per cent of the trees were butt rotted.

The most effective improvement measures to keep down stump to sprout decay can be taken when a stand is less than 20 years old and preferably 8 to 15 years. During this period the proper heights of origin and sizes of parent can be favored. Also wounds at this stage are too small for an effective entrance point of decay.

The effectiveness of any treatment will depend on sound judgment and careful cultural practices in management of sprout forests.